W'00 SCHEDULE FOR DARTMOUTH'S TROPICAL BIOLOGY PROGRAM - COSTA RICA

Date		Location	Morning	Afternoon	Evening
5 Jan	W	To San Jose	Travel	Travel	Arrive in evening
6 Jan		In San Jose	OTS, Serpentarium	INBIO., shop. etc.	Dinner in SJ
7 Jan		To Palo Verde	Travel	Orientation	Lec: Intro to tropical ecology/CR
8 Jan		At Palo Verde	Orientation	20 questions	Lec: Tropical diversity (LA, SLaP)
9 Jan		At Palo Verde	FP-1 (ant-acacia)	Stat lab/computer lab	Data analysis
10 Jan		At Palo Verde	FP-2	Insect lab	FP-1 reports
11 Jan		At Palo Verde	FP-2	Vertebrate lab	Lec: Primate ecol. & beh (BA)
12 Jan	W	At Palo Verde	Comp. project	Plant lab	Data analysis/writing
13 Jan		At Palo Verde	SIFP-1	SIFP - 1	FP-2 reports
14 Jan		At Palo Verde	SIFP-1	Data analysis	Lec: Conservation Issues (Gonzalez)
15 Jan		At Palo Verde	Recon.	Data analysis	SIFP-1 reports
16 Jan		To Santa Rosa	Travel/walk	Orientation	Disc: Turtle biology
17 Jan		At Santa Rosa	Field (mangroves)	mangr & shore(CDL)	Field
18 Jan		To Monteverde	Walk	Travel	Discussion
19 Jan	W	At Monteverde	Orientation	Orientation	Lec: Coevolution (JV)
20 Jan		At Monteverde	Comp. Project	SIFP-2 planning	Guest Lec: (Pounds)
21 Jan		At Monteverde	SIFP-2	SIFP-2	Data analysis
22 Jan		At Monteverde	SIFP-2	Writing lab	Lec: Bird social behavior (AB)
23 Jan		At Monteverde	Data analysis	Report writing	Guest Lec: Bat biology
24 Jan		At Monteverde	Report revisions	SIFP-2 reports (EM)	Field: bats
25 Jan		At MV, to SJ	Recon	Travel to SJ	free
26 Jan	W	In San Jose	free	free	free
27 Jan		To Cerro	Travel/Cerro	Orientation	Lec: Pollination/seed disp. (MJ)
28 Jan		At Cerro	SIFP-planning	SIFP-3	Lec: Herp ecology (CS)
29 Jan		At Cerro	SIFP-3	SIFP-3	Data analysis Data
30 Jan		At Cerro/to La Palma	SIFP-3 reports	Travel to La Palma	free
31 Jan		To Corcovado	Walk/orientation	Walk/orientation	Discussion
1 Feb		At Corcovado	Orientation	FP-3 planning	Lec: Social insects (MC)
2 Feb	W	At Corcovado	FP-3	Data analysis	Lec: Trop. Bird ecology (AF)
3 Feb		At Corcovado	Comp. project	SIFP-planning	FP-3 reports
4 Feb		At Corcovado	SIFP-4	SIFP-4	Lec: Plant-herbivory (MF)
5 Feb		At Corcovado	SIFP-4	SIFP-4	Data analysis
6 Feb		At Corcovado	SIFP-4	Data analysis	Lec: Trop. aquatic ecology (JM)
7 Feb		At Corcovado	Recon	Data analysis	SIFP-4 reports
8 Feb		CV to Las Cruces	walk	travel	Discussion
9 Feb	W	At Las Cruces	Orientation	Plant taxonomy	Lec: Conservation biology (MC)
10 Feb		At Las Cruces	Plant practicum	Recon	Report revisions
11 Feb		Las Cruces/to SJ	Travel to SJ	free	free
12 Feb		To La Selva	Travel/Poas NP	Orientation	Lec. LaSelva (R. Matlock)
13 Feb		At La Selva	Orientation	Project planning	Lec: Trop. forest dynamics (KM)
14 Feb		At La Selva	Comp project	SIFP-5 proposals	Lec: (guest?)
15 Feb		At La Selva	SIFP-5	SIFP-5/Data anal.	Report writing
16 Feb	W	At La Selva	SIFP-5	CP Data anal./writing	Comp proj. reports
17 Feb		At La Selva	SIFP-5	SIFP-5	Lec: Conserv. & biodivers. (ZMcL)
18 Feb		At La Selva	Agroecol. field trip	Data analysis	Data analysis
19 Feb		At La Selva	SIFP-5/data/write	Report writing/revis.	SIFP-5 reports
20 Feb		to San Jose	Recon	Travel	Dinner in SJ
21 Feb	M	Depart for Jamaica			

Orientation = becoming acquainted with new site
Recon = Reconnaissance, time to explore site
FP = field problems (staff initiated)
SIFP = student initiated field problems
[Initials after lectures = student paper critiques]

FIELD GROUP A: Arnold, LaPlante, Conte, Brown, Calvi
FIELD GROUP B: Foote, Aucoin Jennings, La Plante, Frank, Mahar
FIELD GROUP C: Veysey, Macintosh, McLaren, Shannon, Manaras,

Inducible response of *Pseudomyrmex spinicola* to herbivory on *Acacia collinsii*

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Cheryl B. Shannon, Jessica S. Veysey

Abstract: The mutualistic relationship between *Pseudomyrmex spinicola* and *Acacia collinsii* is based on ants providing a defense response for the tree in exchange for tree-provided shelter and food. We hypothesized that this ant defense is induced by leaf damage and/or physical disturbance caused by a foraging herbivore. We tested for an inducible response to herbivory by cutting leaflets (simulated herbivory) and by tapping branches (simulated herbivore presence) on host *Acacias*. We found significantly greater ant response to both leaf damage and physical presence compared to controls: there was a 3-fold increase in ant response to leaf damage and a 5-fold increase in response to physical presence. Our results therefore show that *P. spinicola* does provide an inducible defense against herbivory for *A. collinsii*. The cues used by the ants to respond to these disturbances, however, require further study.

Key Words: ant-acacia, inducible defense, mutualism, symbiosis

Introduction

Plants have developed a variety of different defenses in response to herbivory. *Acacia collinsii* in South and Central America has a mutualistic relationship with *Pseudomyrmex spinicola* and other ant species. The ants protect trees from herbivory and competing plants in exchange for food in extra-floral nectaries and protein-rich Beltian bodies (Janzen 1983). These acacia trees have no documented chemical defenses. Instead, their mutualistic ants may function in a way analogous to chemical compounds in other plants. Research has shown that such chemical defenses can be induced by the presence and/or damage caused by herbivores (Ricklefs 1990). We therefore hypothesized that acacia ants may respond to stimuli corresponding to an herbivore attack, i.e., show an inducible response. We predicted that ants would respond to cues released by the host tree when damaged by a foraging herbivore, and/or to the physical presence of an herbivore on the plant.

Methods

The study was conducted on a windy, overcast morning in Palo Verde National Park, Costa Rica, ≈ 1 km E of the OTS field station, and 100 - 200 m south of the road. Twelve well-foliated *A. collinsii* trees, 1 - 4 m tall, were selected haphazardly for each experiment.

Leaf cutting experiment. To investigate the response to leaf damage (simulated herbivory), we haphazardly selected an acacia with healthy-looking foliage in the central range of an eye-level branch on each of the 12 trees. Using a pair of scissors, we snipped treatment leaves once through half of the leaflets on one side of the leaf and once across the top of the rachis. A leaf with similar attributes on the opposite side of each tree, touched in the same manner, served as a control. Instantaneous counts of the ants present on the cut leaf and the control leaf were taken at 10 s intervals for 30 s before and 60 s after cutting and then at 30 s intervals for the next 5 min. To control for differences in baseline ant activity among sampled trees, the average of pre-treatment ant abundance for each tree was subtracted from post-treatment ant abundance on that tree at each sample time. These relative ant abundances were analyzed in a repeated measures analysis of variance.